December 1, 2000

Mr. Oliver D. Kingsley, President
Nuclear Generation Group
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: BYRON AND BRAIDWOOD STATIONS REQUEST FOR ADDITIONAL INFORMATION REGARDING PLANT "INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS (IPEEE) (TAC NOS. M83600, M83601, M83593, AND M83594)

Dear Mr. Kingsley:

By letters dated December 23, 1996 (for Byron), and June 27, 1997 (for Braidwood), Commonwealth Edison Company (ComEd) responded to Nuclear Regulatory Commission (NRC) Generic Letter 88-20, Supplement 5, "Individual Plant Examination of External Events (IPEEE) for Severe Accidents." Following an initial review of the submittals, the NRC sent Requests for Additional Information (RAIs) on July 9, and July 23, 1998. ComEd provided its responses on January 28, July 15, and September 30, 1999.

In reviewing the RAI responses and comparing the answers for the two sites, additional questions were developed in order to better understand the RAI responses in light of the similar designs of the plants. The additional questions are included in the enclosed RAI. The questions were discussed with members of your staff during a telephone call on November 14, 2000. During the telephone discussions, it was agreed that answers to the RAI would be provided within 30 days of receipt of the request.

Please contact me at 301-340-0867, if there are questions regarding this RAI.

Sincerely,

/RA/

George F. Dick, Jr., Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, and STN 50-457

Enclosure: As stated

cc w/encl: See next page

cc:

Ms. C. Sue Hauser, Project Manager
Westinghouse Electric Corporation
Energy Systems Business Unit
Post Office Box 355
Pittsburgh, Pennsylvania 15230

Joseph Gallo
Gallo & Ross
1025 Connecticut Ave., NW, Suite 1014
Washington, DC 20036

Howard A. Learner
Environmental Law and Policy
Center of the Midwest
35 East Wacker Dr., Suite 1300
Chicago, Illinois 60601-2110

U.S. Nuclear Regulatory Commission
Byron Resident Inspectors Office
4448 N. German Church Road
Byron, Illinois 61010-9750

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, Illinois 60532-4351

Ms. Lorraine Creek
RR 1, Box 182
Manteno, Illinois 60950

Chairman, Ogle County Board
Post Office Box 357
Oregon, Illinois 61061

Mrs. Phillip B. Johnson
1907 Stratford Lane
Rockford, Illinois 61107

George L. Edgar
Morgan, Lewis and Bockius
1800 M Street, NW
Washington, DC 20036-5869

Attorney General
500 S. Second Street
Springfield, Illinois 62701

Illinois Department of Nuclear Safety
Office of Nuclear Facility Safety
1035 Outer Park Drive
Springfield, Illinois 62704

Commonwealth Edison Company
Byron Station Manager
4450 N. German Church Road
Byron, Illinois 61010-9794

Commonwealth Edison Company
Site Vice President - Byron
4450 N. German Church Road
Byron, Illinois 61010-9794

U.S. Nuclear Regulatory Commission
Braidwood Resident Inspectors Office
35100 S. Rt. 53, Suite 79
Braceville, Illinois 60407

Mr. Ron Stephens
Illinois Emergency Services
and Disaster Agency
110 E. Adams Street
Springfield, Illinois 62706

Chairman
Will County Board of Supervisors
Will County Board Courthouse
Joliet, Illinois 60434

Commonwealth Edison Company
Braidwood Station Manager
35100 S. Rt. 53, Suite 84
Braceville, Illinois 60407-9619

Ms. Bridget Little Rorem
Appleseed Coordinator
117 N. Linden Street
Essex, Illinois 60935

Document Control Desk-Licensing
Commonwealth Edison Company
1400 Opus Place, Suite 400
Downers Grove, Illinois 60515

Commonwealth Edison Company
Site Vice President - Braidwood
35100 S. Rt. 53, Suite 84
Braceville, Illinois 60407-9619

Mr. David Helwig
Senior Vice President
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 900
Downers Grove, Illinois 60515

Mr. Gene H. Stanley
Vice President - Nuclear Operations
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 900
Downers Grove, Illinois 60515

Mr. Christopher Crane
Senior Vice President - Nuclear Operations
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 900
Downers Grove, Illinois 60515

Mr. R. M. Krich
Vice President - Regulatory Services
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, Illinois 60515

Commonwealth Edison Company
Reg. Assurance Supervisor - Braidwood
35100 S. Rt. 53, Suite 84
Braceville, Illinois 60407-9619

Commonwealth Edison Company
Reg. Assurance Supervisor - Byron
4450 N. German Church Road
Byron, Illinois 61010-9794

Ms. Pamela B. Stroebel
Senior Vice President and General Counsel
Commonwealth Edison Company
P.O. Box 767
Chicago, Illinois 60690-0767

Mr. Oliver D. Kingsley, President December 1, 2000
Nuclear Generation Group
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: BYRON AND BRAIDWOOD STATIONS REQUEST FOR ADDITIONAL INFORMATION REGARDING PLANT "INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS (IPEEE) (TAC NOS. M83600, M83601, M83593, AND M83594

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Sincerely,
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George F. Dick, Jr., Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, and STN 50-457

Enclosure: As stated

cc w/encl: See next page

Distribution:	PUBLIC	PD3-2
S. BLACK	A. MENDIOLA	OGC
C. MOORE	L. BERRY	ACRS
E. CHOW	A. RUBIN	LWIENS
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REQUEST FOR ADDITIONAL INFORMATION

RELATED TO

INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS

COMMONWEALTH EDISON COMPANY

BYRON STATION, UNITS 1 AND 2

BRAIDWOOD STATION, UNITS 1 AND 2

DOCKET NOS. STN 50-454, STN 50-455, STN 50-456 AND STN 50-457

INTRODUCTION

An examination and comparison of the responses to Requests for Additional Information (RAIs) related to the fire individual plant examination of external events (IPEEE) assessments for Byron and Braidwood has resulted in additional staff questions. The additional questions seek further insight into the plant and analysis features that appear to have had substantial impacts on the fire risk estimates for each plant. While these questions may have relevance to the treatment of many plant areas, in order to limit the question and response scope, the licensee is requested to focus its attention and responses on the treatment of main control room (MCR) abandonment scenarios and scenarios involving the auxiliary electric equipment room (AEER) as described in the supplemental RAIs (SRAIs) which follow.

In considering the IPEEE submittals and responses to previous RAIs, it appears that the AEER in each plant is a potential "pinch point" in a plant that otherwise shows good separation between safety divisions. Many of the functions normally found in the MCR are apparently housed in the AEER for Braidwood and Byron. This has led to a number of potential questions regarding the IPEEE treatment of these areas and the substantial differences between both the absolute and relative risk contributions for these areas at the two plants. The numerical results indicate that the AEER is a significant contributor to fire risk at Braidwood, while being relatively unimportant at Byron. Indeed, at Braidwood, the AEER ranks among the top fire core damage frequency (CDF) contributors, while at Byron, the contribution is small both in absolute terms and with regard to the relative ranking of the AEER in comparison to other fire areas. Furthermore, it is not clear that the relative rankings of the AEER and MCR accurately reflect the relative fire risk associated with these areas. The following questions are intended to further clarify the basis for these results.

SRAI 1 - Fire Frequency for the AEER

Tables 17-1 and 17-3 of the original RAI #17 responses for both Braidwood and Byron show some of the factors considered in the quantification of the AEER fire CDF (i.e., compartment frequency, individual scenario fire frequencies (partitioned to specific fire sources) and conditional core damage probability (CCDP) values). These tables show the values to be somewhat different between the two plants, and there could be some potential discrepancies.

Note that Table 17-1 of each plant's previous RAI responses shows the overall AEER compartment fire frequency to be 2.4E-3/yr (i.e., the overall compartment frequency is the same for both plants). However, the staff is unable to reconstruct this overall compartment frequency accurately for either of the two plants using the individual fire scenario frequency values that appear in Table 17-3. For Byron, summing the individual scenario frequencies for the AEER as shown in Table 17-3 yields a total fire frequency somewhat lower than the overall compartment frequency from Table 17-1. This may be an indication that some ignition sources were screened. A similar exercise for Braidwood yields a summed AEER fire frequency from Table 17-3 that is approximately twice the overall compartment frequency shown in Table 17-1. In each case, the inability to reproduce the overall compartment fire frequency is a potential discrepancy that may have impacted the final CDF estimates.

> Please review the fire frequency values cited in Tables 17-3 for individual fire scenarios within the AEER. Demonstrate that the overall fire frequency for the AEER as given in Table 17-1 is preserved in (or can be reconstructed from) the individual fire scenario frequencies shown in Table 17-3. Identify any individual fire scenarios that have been screened out at this stage of the analysis, and provide a basis for their screening. Please explain or resolve any remaining discrepancies between the overall compartment frequency from Table 17-1 and the individual scenario frequencies from Table 17-3 for each plant. Compare the values in Table 17-3 for the two plants to each other, and justify any numerical differences in the individual fire scenario frequency estimates that might remain between the two plants.

<u>SRAI 2 - Conditional Core Damage Probability Estimates for the AEER</u>

The CCDPs assumed for fire scenarios impacting the AEER appear to be significantly different between Byron and Braidwood even though the room contents, functions, fire sources and postulated fire scenarios appear identical. Table 17-3 shows a compartment CCDP of 8E-4 at Braidwood versus 1.1E-4 at Byron. It is not clear whether this difference is due to physical or functional differences between Byron and Braidwood (e.g., cable routing, plant systems design and physical plant layout) or is due to differences in analysis assumptions (e.g., extent of postulated damage, impact on plant systems, reliability of other mitigating systems, reliability of recovery actions, etc).

> Please discuss the physical differences between the AEERs at Byron and Braidwood and identify and discuss any differences in analysis assumptions that led to the determination that the CCDP for the AEERs at the two sites were substantially different. For each plant provide an estimate of the CCDP assuming loss of all equipment and functions in the AEER and describe the method of shutdown provided against such a fire loss. Describe how the individual fire scenario CCDP values corresponding to each of the fire scenarios identified in Table 17-3 were derived (e.g., where is the fire assumed to start, what equipment is being damaged in each scenario, where is the damaged equipment located in relation to the fire source, what functions are being impacted by the postulated equipment damage, how is safe shutdown achieved, can the scenario lead to MCR abandonment, was suppression credited in the quantification, and if suppression was credited, was the failure to suppress the fire in a timely manner

considered). Identify any fire scenarios where fire modeling and/or judgement were used either explicitly or implicitly as the basis for assuming limited or localized fire damage. For each such case, justify the assumptions that led to the conclusions that fire damage would be limited. Specifically discuss the quantification of fire scenarios in which fire suppression either fails or fails to be effective in a timely manner and the contribution of such scenarios to fire CDF.

SRAI 3 - CDF Contribution for the AEER

The quantification of fire-induced CDF resulted in significant differences in the CDF contributions for the AEERs at Byron and Braidwood both in terms of the absolute value of the CDF and in the relative importance of the AEER to plant fire risk.

Please consider the responses to SRAIs 1 and 2, and reassess the CDF contribution of the AEER at both Byron and Braidwood. Compare the results for the two plants and provide a basis for any remaining differences.

SRAI 4 - Remote Shutdown and MCR Abandonment Scenarios

The remote shutdown process for both Byron and Braidwood is described as involving coordination of a number of proceduralized actions taken from the control room and possibly from multiple remote locations. Throughout the IPEEE fire study the numerical values for remote shutdown CCDPs (i.e., the conditional probability of failure to control the plant during remote shutdown operations) appear to be optimistic for such a distributed shutdown effort requiring actions in multiple plant locations. The values also appear optimistic in comparison to analysis results for other plants, even including plants with localized remote shutdown capabilities that do not require significant actions in other than a single location. It is also not clear which control room abandonment scenarios have been included in the final CDF quantification. For example, the previous RAI responses state that MCR abandonment may occur due to fires in the AEER, but it is not apparent that any such scenarios have been quantified. Hence, it is not possible to determine how important the assumed reliability of remote shutdown was to the quantification of fire CDF at either plant.

Please describe in greater detail the actions required to achieve safe shutdown given abandonment of the MCR (e.g., what functions, controls and indications are available to support remote shutdown operations, what specific actions must be taken, where does each action take place, what is the time frame available to complete the actions, what are the consequences of failure to complete each action in a timely manner, how are actions coordinated, and what training is provided to the operators with regard to remote shutdown actions). Describe the human reliability analysis (HRA) analysis that was performed to assess the reliability of these actions. Justify the assumed remote shutdown reliability estimate (0.003 failure probability) or provide a revised estimate of remote shutdown reliability. Identify all of the fire scenarios that might lead to MCR abandonment and a reliance on remote shutdown. Describe how each such scenario was quantified (or screened) and quantify the total contribution of such scenarios to plant fire CDF. Evaluate the change in the fire CDF if the remote shutdown failure probability is arbitrarily increased by one order of magnitude.

SRAI 5 - MCR Controllability and Habitability Issues due to AEER Fires

In the original IPEEE submittal and in the licensee's responses to original fire RAIs #1, #2, and #3, the AEER was likened to a control room in terms of cabinet functions and cabinet contents. Original fire RAI #3 specifically asked whether complications related to control of the plant due to AEER fires resulted in MCR evacuation scenarios. The question concerned both the loss of control of systems from the control room ("controllability") as well as smoke migration into the control room that could necessitate evacuation ("habitability"). The RAI response indicated that for AEER fires, plant control issues were addressed through a combination of actions within the MCR as well as outside of the control room. Numerical evaluations in Table 17-3 are presumed to already include these actions. The responses to the original RAIs are acceptable on this point (controllability). However, with regard to habitability concerns, smoke migration into the MCR from postulated AEER fires, according to the RAI response, is precluded by seals and dampers. Plant drawings appear to indicate at least one doorway between each AEER and the MCR. Also, testing of the seals during licensing was mentioned, but no maintenance or later validation testing was described. Finally, fire doors and penetration seals are designed to preclude the spread of fire and flames, but may allow for the spread of smoke and toxic gasses. For penetration seals, decomposition of the seal materials themselves may lead to toxic gas production on the protected side of the barrier.

> Please state whether or not there are doorways between the AEERs and control room. If such doorways do exist, provide a description of the doors and discuss how the potential for smoke or toxic gas spread through the doors was addressed. Estimate the fire CDF contribution if it is assumed that fires in the AEER may force a total abandonment of the MCR due to habitability concerns (i.e., assuming that no further actions could be taken from the MCR).

SRAI 6 - AEER versus MCR Fire CDF

The AEERs at each plant would appear quite similar to a MCR at other plants in terms of the room contents, functions and fire sources. Such comparisons were made in both the original IPEEE submittal and in the responses to the original fire RAIs. For example, the Byron and Braidwood IPEEE submittals note that the relay and circuit card cabinets normally found in the MCR are predominantly located in the AEERs. As a result, much of the control room fire frequency was allocated to the AEERs. The most significant apparent difference between the AEERs and a typical MCR appears to be the fact that the Byron and Braidwood AEERs are not continuously manned, whereas MCR areas are. In general, substantial credit is given in fire probabilistic risk assessments (PRAs) to the fact that the MCR is continuously manned so that rapid intervention in fires that do occur can be assumed with a high reliability. At Byron and Braidwood, the CDF contributions for the AEER are lower than typically cited estimates of MCR fire CDF at other plants. Nominally, because the AEERs look much like unmanned control room spaces, one would anticipate that the CDF contribution would be comparable to, if not greater than, the CDF contribution for MCR areas in other plants. Furthermore, at Byron, the AEERs' contributions to the fire CDF are approximately a factor of eight and a factor of sixteen less than that of the corresponding control rooms.

Please review the estimates of the AEER fire CDF (including the responses to SRAIs 1-5 above). Provide a specific justification for the relative contribution of the MCR and AEER to fire CDF at each plant in light of the above discussions.